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$$
\begin{array}{rr}
nV = 39 \times .1{\cdot}23521. = & 48{\cdot}1731 \\
+ & 3{\cdot}5158 \\
\hline
 & 51{\cdot}6889 \\
- & 18{\cdot}5943 \\
\hline
\lambda 1{\cdot}51975 = & 33{\cdot}0946 \\
vm = & \lambda \bar{3}{\cdot}79130 \\
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\text{Answer } {\cdot}20467 = & \lambda \bar{1}{\cdot}31105
\end{array}
\qquad
\begin{array}{rl}
Y & = \lambda\, \bar{2}{\cdot}37221 \\
\frac{1}{x^2} & = \lambda\, \bar{1}{\cdot}97432 \\
\overline{x^2}\Big|^{40}_{-1} & = \lambda\, {\cdot}98412 \\
\left(\frac{1}{x^2-1}\right) & = \lambda\, 1\ 21538 \\
\hline
 & \lambda\, {\cdot}54603 = 3{\cdot}5158 \\
\left(X+X^2\right) = V' & = \lambda\, \bar{1}{\cdot}41064 \\
\frac{x^{40}-1}{x-1} & = \lambda\, 1{\cdot}85874 \\
\hline
 & \lambda\, 1{\cdot}26938 = 18{\cdot}5943
\end{array}
$$

By Edmonds ·20772
Difference ·00305

Examples might be given from other tables, and the formula for Survivorship Annuities and Assurances deduced by the same reasoning. But these, together with the more difficult application of the proposed method to ages at which the increase of mortality is so much more rapid, namely, at 55 and upwards, must be reserved for another paper.

S. B.

25th May, 1850.

THE HISTORY OF ASSURANCE.

On indirect Methods of acquiring Knowledge.—The Method of History.—The First Table of Mortality. By Edwin James Farren, Esq.

The term scholar, as current in the English language, has two extreme acceptations, tyro and proficient; or what the later Greeks fancifully termed the alpha and omega of acquirement. If we attempt to trace the steps by which even the adult student of any especial branch of professional or literary knowledge has fairly passed the boundary defined by the one meaning in passing on to that position denoted by the other, it will commonly be found, that in place of that lucid order, that straight line from point to point, which theory and resolve generally premise, the real order of acquirement has been desultory—the real line of progression, circuitous and uncertain. Having, however, by dint of perseverance, achieved so much of the journey as will enable him to look back with something like exultation upon the distance traversed, the traveller can scarcely help imagining that he is now already in a position to indicate to others a road more direct than that by which he has actually passed. He would close up certain bye-ways, would avoid certain windings, and concludes that by such means his own progress might have been materially advanced. As he further progresses, however, and still finds he can proceed but slowly in the direct line, the conviction at last comes, for, in defiance of his own resolves, it is rarely that he can exclude his own example from the category, that certain *indirect* roads and bye-paths, commonly disregarded as divergent and merely tending to unnecessary delay, are really necessary auxiliaries for the proper survey of surrounding objects, and are essential elements in relieving the monotony of the journey by diversifying the prospect and displaying it in different points of view; for without these alleviations, the mind itself begins to doubt the compensating value of that ultimatum which *in limine* exacts so much toil and affords so little recompense. We become the more convinced that this deviation from the straight and narrow path of theoretical instruction, is really a practical necessity, if while we acknowledge memory to be the function by which we mentally acquire, we consider its sources and action. During childhood the sum of knowledge is nearly wholly obtained by direct means, scarcely anything can be said to be learned that has not been acquired by obvious rote; while after childhood, the memory is rarely, if ever, directly tasked, but is allowed to acquire its own stores by means so indirect, that the possessor himself is barely conscious of his own resources until occasion prompts some demand from the storehouse of his knowledge, and the supply is found ample or scanty as the efforts of a bye-gone industry may have been well or ill directed. Metaphysicians have recognised this difference between child-like and adult, or between direct and indirect memory; and leaving the first wholly unexplained, have traced the second to the association of ideas; while others have further attempted to reduce this to principles under the name of a science of mnemonics, by which certain elements of association are defined and proposed as land-marks to which the memory may from time to time revert by the direct powers of rote. Clever, however, as some of these systems of technical memory have been, they have all gradually fallen into neglect, and the problem still remains unresolved as to the most certain method of at once storing the memory and rendering its stores immediately available, however distant and unexpected the demand. While metaphysicians and others have thus been vainly engaged in attempts to systematise this subject, practice has pointed out an auxiliary method both pleasing and useful, and this method is what may be termed "the method of history." Every subject has its history, and the history of every subject supplies abundance of those very details, as elements for the association of ideas, upon which the function of adult memory is supposed to depend. The progress of history is from simple to complex, the acquirement of any art or science commonly follows the same progression, and not unfrequently treads in the same steps. The "has been" thus becomes the hewer of wood and drawer of water to the "is," as the "is" will be to the "time to come." A knowledge indeed of the history of any class of literature in which we are interested, is the only safeguard we possess against our producing conceptions as new, merely because they are our own, without having made ourselves duly acquainted with what has been produced by others who have gone before us. Mathematicians may be said to have especially erred in this respect, as the diligent reader of Montucla will confirm; for how much labour has often been unconsciously expended in merely reproducing theorems and formula already announced by others; and how many eminent names might be included in the list of plagiarists, unless allowance were made for a deficient knowledge of the history of the subject as developed in writings anterior to their own. The secretary's record of nearly every scientific society has presented lamentable instances of a similar character, in which a life almost may have been spent in labours founded upon some notion, doctrine, or invention considered by the presumed originator as important and new, but which when examined, not in the dark recesses of a solitary enthusiast's closet, but in the open daylight of a general and comprehensive literature, may prove indeed to be important, and so important as to have been already tested and acted on, but considered as new, must be passed aside as merely a curious, because an honest coincidence with the discoveries of previous investigators. Whatever doubts therefore might arise as to the utility of a knowledge of the past history of any subject, *per se*, none can really exist as to its being a powerful auxiliary in aiding our proper understanding of the means and appliances of the present. Esteeming history, therefore, as at least among the indirect elements of a liberal knowledge of any art or science, the Editors of the *Assurance Magazine* have been desirous not to wholly exclude articles of a historical description from their pages, and more especially from their first number; and in compliance with this desire, the present writer has ventured to offer the preceding reflections for the reader's consideration, and to add the following contribution as a species of chapter from the early history of Life Contingencies. It is true that to readers already well acquainted with any subject, but little really new can ever be offered, but as it is hoped that the *Assurance Magazine* will also pass into the hands of persons not hitherto particularly conversant with its legitimate topics, any means of extending such information among educated persons in general appears to be extremely desirable, and the more so, because general readers can scarcely be expected to refer to works except of the present description. In selecting, therefore, an initiatory topic from Life Contingencies, a glance at the origin and construction of the first Table of Mortality upon record, has appeared about the most suitable, and the writer has accordingly endeavoured to treat the matter in as general a style as the nature of the subject and the brevity of a magazine article will permit.

The spur of necessity has in all the paths of life and literature generally produced evidences of its useful application, whether the force of such necessity have been want of money, desire of fame, or the presence of some other exciting cause to determined action. The early history of Tables of Mortality appears to present us with one of these examples. The Royal Society, established in 1660, after having passed through the first stage, since ascertained to be common to scientific institutions, of no want of topics upon which to descant, or of writers willing to treat of them, passed into the no less common second stage, of the dearth of such attributes, when novelty has passed away, when *prestige* has spent its force, and the hitherto willing coadjutor begins to temporise and is no longer content to tug at the labouring oar. In any society, however, really destined to maintain its place among the living, a reaction takes place—its own energies are once more severely tasked to sustain its own existence, and to listlessness succeeds a resolute activity; so with the Royal Society. After having for some years suspended the publication of their

"Transactions" or "Collections," the resolution was taken that a regular issue of the "Transactions" should be persevered in; and in some respects to insure this, the active-minded Mr., afterward the celebrated Dr. Halley, undertook, at a meeting of the Council, Dec. 7, 1692 (*vide* Weld's History of the Royal Society, vol. i. p. 326), to furnish "*de proprio*," five sheets in twenty! Although subsequent experience illustrated that, by the aid of other contributors, this unusual proportion was not really to be exacted from this zealous labourer; yet in the mind of such a man as Halley, the promise would in the interim have all the attributes of a necessity, and he would consequently omit no opportunity of pressing into the service whatever details might present themselves as suitable *points d'appui* upon which to found the fulfilment of his pledge. Accordingly the very first paper he presented to the society after this meeting of the Council was one which we have ventured to surmise was the offspring of this implied necessity of redeeming his guaranteed services as a contributor. The paper was entitled "An Estimate of the Degrees of Mortality of Mankind, drawn from curious Tables of the Births and Funerals at the City of Breslaw; with an attempt to ascertain the price of Annuities upon Lives, by E. Halley, R.S.S.," and was presented in the early part of 1693. The Society had often previously had accounts forwarded to them of the baptisms and burials of different places, and such accounts had accordingly been inserted in the "Transactions" almost without comment. But M. Justell, an old and zealous contributor, having recently sent accounts from Dr. Neuman, of Breslaw, not only of the number of births and deaths, but of the *ages* of those dying there, in the five years, 1687 to 1691, Dr. Halley immediately perceived that a very interesting paper might be founded upon such materials; but he could scarcely have conceived that in framing this paper, and thereby constructing the first Table of Mortality upon record, he was also laying the foundation of so important a science as the doctrine of Life Contingencies is now universally allowed to be. The original paper will be found in the Phil. Tr. vol. xvii. p. 596. We propose on the present occasion to merely offer a resumè of its principal contents, in such a manner as to familiarly reconstruct the Table of Mortality, by the same mode of proceeding as Dr. Halley may be presumed to have done; as suggested by the materials with which he has furnished us. We have already designated the Table of Mortality so produced as the earliest upon record, but it may be further considered as the very *fons et origo* of all those that have been subsequently offered; for however much the data and method of construction of modern Tables of Mortality may differ, their form remains the same as first proposed by Dr. Halley in 1693.

The collective numbers of births and deaths in Breslaw during the five years, 1687 to 1691, as detailed to Dr. Halley, were respectively 6193 and 5869: numbers so nearly allied to each other, that allowing for levies made for the emperor's service in his wars, or for natives of Breslaw, who might die abroad, Dr. Halley was induced to make the assumption, that the total number of the population relating to Breslaw, whatever number that might be, was nearly stationary in amount and distribution, and the more so, because the occupation of the people favoured the supposition that the confluence of strangers would be but small. The importance of this assumption of the population being in all respects of a stationary character will be presently seen. The next step, was to compare the number of deaths at the different ages. The comparison showed that the list of deaths, after childhood, although irregular in some parts of the series, was regular in others. Dr. Halley appears therefore to have taken as his second assumption, that the numbers of deaths, at any two contiguous ages, after childhood, were also as it were contiguous in amount, or that there were no ages after childhood, that could be considered as especially favourable or fatal when compared with the mortality at ages adjacent to them. When small numbers were concerned, as for instance in Breslaw, where the total number of deaths in a year did not exceed the fifth part of 5869 or 1174 per annum, for all ages collectively from birth to 100, or about 12 per age, this assumption virtually resolved itself into the supposition that the year's deaths in Breslaw at any two contiguous ages, after childhood, would either be equal in amount, or would not differ by more than a unit from each other. Aided by this latter form of the assumption, after assigning probably from his materials the number of deaths during childhood or from 1 to 8 years of age as 145, 57, 38, 28, 22, 18, 12, and 10 respectively, he regulated the succeeding deaths, age by age, as in the following series, observing as before stated the principle of equality, or of numbers merely differing by unity for contiguous ages, commencing with 10 deaths as the number allotted to the age of 8. The lower or third line has been added to show the original numbers afforded by averaging the materials, or the numbers to which Dr. Halley applied his principle of modification to render them more regularly distributed, as they might be supposed to become, if the materials had extended over a greater number of years, as 20 in place of 5, and had included those natives of Breslaw who had died abroad.

Ages.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
Deaths.	10.	9.	8.	7.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	7.	6.	6.	7.	7.	7.	7.	8.	8.
	11.	6.	5½.	5½.	5½.	5½.	2.	3½,	3½.	3½.	5.	6.	6.	4½	6½.	6½.	6½.	6½.	6½.	9.	8.	7.	7.

Ages.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.	41.	42.	43.	44.	45.	46.	47.	48.	49.	50.	51.	52.	53.	54.
Deaths.	8.	8.	8.	9.	9.	9.	9.	9.	9.	9.	9.	10.	10.	10.	10.	10.	10.	10.	11.	11.	11.	11.	11.	10.
	7.	7.	7.	7.	7.	8.	9½.	9½.	9½.	9½.	9½.	8.	9.	9.	7.	7.	7.	7.	10.	*	*	*	*	11.

Ages.	55,	56.	57.	58.	59.	60.	61.	62.	63.	64.	65.	66.	67.	68.	69.	70.	71.	72.	73.	74.	75.	76.	77.	78.	79.
Deaths.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	11.	11.	11.	11.	10.	10.	10.	10.	9.	8.
	9.	9.	10.	10.	10.	10.	10.	10.	12.	9½.	9½.	9½.	9½.	9½.	9½.	14.	9.	11.	9½.	9½.	9½.	9½.	6.	7.	7.

Ages.	80.	81.	82.	83.	84.	85.	86.	87.	88.	89.	90.	91.	98.	99.	100.
Deaths.	7.	6.	5.	3.											
	7.	3.	4.	4.	2.	1.	1.	1.	1.	1.	1.	1.	0.	⅕.	⅗.

Having thus arranged, as in the foregoing list, the number of deaths in relation to each age, Dr. Halley had recourse to his former assumption of the population being stationary to enable him to determine the relative number living at each age, for without the relation of the number of living to the number of dying, it is obvious that the rates of mortality would be still indeterminate. The most useful form of the assumption was to suppose the population of Breslaw so completely stationary, that the number living at any age uniformly consisted of the survivors from the preceding age, and consequently that the numbers living at any two contiguous ages, merely differed in amount by the number of deaths occurring at the younger age. The list of deaths thus became merely a list of differences, so that if the number living at any one age could be ascertained, the relative numbers at the other ages might be easily deduced by the aid of the list of deaths. The number of births being afforded, the age for which it would be most easy to deduce the number of living, would obviously be that of the year following birth, and accordingly Dr. Halley appears to have determined this number in the following manner. The total number of births in the five years being 6193, the annual number would be about 1238, and of these about 348 died at different periods during their first year of age, consequently it seemed a fair assumption, that as 1238 were born throughout the year and only 890 survived the year, that about 1000 might be considered as living *conjointly* in their first year, and thus the number from which the Table of the number of living was to commence, was deduced as 1000 in the *first current* year of age; and from this number the remainder were obtained, as in the following Table, by subtracting the number of deaths in relation to each age.

Age current.	Persons.	Age current.	Persons.	Age current.	Persons.	Age current.	Persons.	Age current.	Persons.	Age current.	Persons.
1	1000	8	680	15	628	22	586	29	539	36	481
2	855	9	670	16	622	23	579	30	531	37	472
3	798	10	661	17	616	24	573	31	523	38	463
4	760	11	653	18	619	25	567	32	515	39	454
5	732	12	646	19	604	26	560	33	507	40	445
6	710	13	640	20	598	27	553	34	499	41	436
7	692	14	634	21	592	28	546	35	490	42	427
43	417	50	346	57	272	64	202	71	131	78	58
44	407	51	335	58	262	65	192	72	120	79	49
45	397	52	324	59	252	66	182	73	109	80	41
46	387	53	313	60	242	67	172	74	98	81	34
47	377	54	302	61	232	68	162	75	88	82	28
48	367	55	292	62	222	69	152	76	78	83	23
49	357	56	282	63	212	70	142	77	68	84	20

Age.	Persons.
7	5547
14	4584
21	4270
28	3964
35	3604
42	3178
49	2789
56	2194
63	1694
70	1204
77	692
84	253
100	107
	34000
Sum Total.	

The total number of persons as thus determined, would amount, it will be seen, to about 34,000; supposing the distribution to have been in accordance with the preceding assumptions. Although it is obvious that the above Table, as thus offered by Dr. Halley, is strictly a Table representing the number of survivors at each age, yet having been constructed from what were then, and long subsequently called Bills of Mortality, use has rendered it the *jus et norma loquendi* in Life Contingencies, to designate this form a Table of Mortality. Such being the origin and nature of this earliest "Table of Mortality," the general reader may expect a closing observation as to its relation to Tables of Mortality in the present day. With respect to its form, as has already been stated, no improvement has as yet been adopted, beyond inserting the column of differences or deaths, and choosing higher numbers for exemplification. Of its two principles of construction, viz., as to the number of living being deducible from the number of deaths, by aid of the assumption of a stationary population; and as to the number of deaths at contiguous ages after childhood being allied in number; the former principle was generally prevalent in the construction of such Tables, until the appearance of Mr. Milne's Carlisle Table in 1815, but is now as generally abandoned; the latter characteristic is still operative and considered as valid in all the best Tables. On deducing the rates of mortality from Dr. Halley's Table these will be found to be considerably greater than those at present relied on, but inasmuch as the interest of money in 1693 was also considerably greater than at present, it may form an interesting conclusion to the present paper, to state the annual premiums for £100 payable at death, in relation to this first Table of Mortality, supposing a Life Assurance Company to have been instituted at the period of the Table's construction, or about 70 years before any Institution based upon a Table of Mortality, admitting distinctions of age, was really publicly established. For the sake of comparison, a similar class of results from the Registrar General's Table of Mortality for Males, as deduced by Mr. Farr from the last census and published in 1844, is added.

Age.	1693. 6 per cent.	1844. 3 per cent.	Age.	1693. 6 per cent.	1844. 3 per cent.
15	1·318	1·418	45	3·506	3·215
20	1·597	1·597	50	4·134	3·873
25	1·875	1·806	55	4·855	4·833
30	2·201	2·054	60	5·968	6·129
35	2·590	2·355	65	7·602	7·851
40	2·981	2·731	70	10·162	10·156

A comparison of the above rates, renders it scarcely an exaggeration to say, that the public might safely have availed themselves of Dr. Halley's skill and of the benefits of Life Assurance, 160 years ago, upon nearly the same terms deduced from the first Table of Mortality, and the rate of interest then current, as can now be granted to the public, with a reduced rate of mortality and a corresponding reduction in the interest of money.

E. J. F.